

REMARKS

Claims 1, 2, 4-6, 8-20, 23-25, 27, and 28 remain pending in the above-identified application.

Applicant acknowledges the allowance or allowability of claims 6, 8-10 and 27.

Section 102(e)

Applicant respectfully requests reconsideration of the rejection of claims 1, 2, 11-16, 18, 23-25, and 28 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,319,742 (Hayashi).

Claims 1, 2, 11-16, and 18

Each of claims 1, 2, 11-16, and 18 recites a method of manufacturing a crystal comprising **growing a crystal** of a III-V compound of the nitride system **wherein the growth step includes forming a first III-V nitride pattern in one position in the crystal** in a direction of a thickness of the crystal, the first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and **the growth step includes forming a second III-V nitride pattern in another position in the crystal** in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the pitch of the first pattern and the pitch of the second pattern are different and the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different pitches of the first pattern and the second pattern.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO₂ film layers 30, and

another GaN layer 24. See Fig. 13. Hayashi does not disclose a method of manufacturing a crystal comprising growing a crystal of a III-V compound of the nitride system wherein the growth step includes forming a first III-V nitride pattern in one position in the crystal in a direction of a thickness of the crystal, the first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and the growth step includes forming a second III-V nitride pattern in another position in the crystal in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the pitch of the first pattern and the pitch of the second pattern are different and the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different pitches of the first pattern and the second pattern.

The Office Action asserts that the current blocking layer 31 of Hayashi is equivalent to the second nitride pattern of the present claims. However, the current blocking layer 31 is not part of the crystal, which Hayashi refers to as the nitride based semiconductor layer. See *e.g.*, column 14, lines 14-21. Various embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action refers to, shows the crystal positioned below a semiconductor device, namely a laser device. See column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. See *e.g.*, specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer..." (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. See page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. See e.g., Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the first and second nitride patterns in Hayashi are analogous to the recesses and projections topped by the SiO₂ film 30. See e.g., column 12, lines 21-29. However, these recesses and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

Because the reference fails to disclose every feature of the claims, the rejection is improper. Accordingly, Applicant respectfully requests the rejection be withdrawn.

Claims 23, 24, and 28

Claims 23, 24, and 28 recite a method of manufacturing a device by **forming a device film on a surface of one of a crystal substrate and a crystal film**, the method comprising **forming one of the crystal substrate and the crystal film by growing a crystal** of a III-V compound of a nitride system having a thickness on a surface of a basal body, and **forming the device film on one of the crystal substrate and the crystal film**, the device film having a light-emitting portion including a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer, wherein **the growth step includes forming a first pattern** including a plurality of first elements distributed in a lateral direction with respect to the crystal in at least one pitch, the first pattern being formed in one position in the crystal in a direction of the thickness of the crystal, each of

the first elements having at least one width measured in the lateral direction, and **the growth step includes forming a second pattern** including a plurality of second elements distributed in the lateral direction in at least one pitch, the second pattern being formed in another position in the crystal in the direction of the thickness of the crystal, each of the second elements having at least one width measured in the lateral direction, wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal, and wherein the light-emitting portion overlies a region of the crystal where the second pattern overlies the first pattern so that dislocations that may form in the crystal adjacent the basal body generally do not reach the light-emitting portion.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO₂ film layers 30, and another GaN layer 24. See Fig. 13. Hayashi does not disclose a method of manufacturing a device by forming a device film on a surface of one of a crystal substrate and a crystal film, the method comprising forming one of the crystal substrate and the crystal film by growing a crystal of a III-V compound of a nitride system having a thickness on a surface of a basal body, and forming the device film on one of the crystal substrate and the crystal film, the device film having a light-emitting portion including a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer, wherein the growth step comprises forming a first pattern including a plurality of first elements distributed in a lateral direction with respect to the crystal in at least one pitch, the first pattern being formed in one position in the crystal in a direction of the thickness of the crystal, each of the first elements having at least one width measured in the lateral direction, and forming a second pattern including a plurality of second elements distributed in the lateral direction in at least one pitch, the second pattern being formed in another position in the crystal in the direction of the thickness of the crystal, each of the second elements having at least one width measured in the lateral direction, wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction

of the thickness of the crystal, and wherein the light-emitting portion overlies a region of the crystal where the second pattern overlies the first pattern so that dislocations that may form in the crystal adjacent the basal body generally do not reach the light-emitting portion.

Regarding claims 23, 24, and 28, the Office Action maintains that the current blocking layer 31 of Hayashi is equivalent to the second nitride pattern of the present claims. However, the current blocking layer 31 is not part of the crystal, which Hayashi refers to as the nitride based semiconductor layer. *See e.g.*, column 14, lines 14-21. Various embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action refers to, shows the crystal positioned below a semiconductor device, namely a laser device. *See* column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. *See e.g.*, specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer..." (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. *See* page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. *See e.g.*, Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the first and second nitride patterns in Hayashi are analogous to the recesses and projections topped by the SiO₂ film 30. *See e.g.*, column 12, lines 21-29. However, these recesses and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a

pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

In addition, claims 23, 24, and 28 recite forming a device on the crystal substrate or film. The device 36 of Hayashi is shown in Fig. 13 above the crystal (see e.g., column 14, lines 7-10) and the current blocking layer 31 is clearly a part of that device and not a part of the crystal. Accordingly, the current blocking layer 31 is not analogous to a nitride pattern formed in a step of growing the crystal, as claimed.

Moreover, the claims describe that the device includes a light-emitting portion comprising a cladding layer having a protrusion, a contact layer formed on the cladding layer only above the protrusion, and an electrode formed on the contact layer. Hayashi does not disclose these claim elements and the Office Action fails to specifically address them. Hayashi discloses a cladding layer 27 that is a part of the device 36, which is formed above the crystal 36. Because the current blocking layer 31 is formed above the cladding layer 27 of the device, the current blocking layer is clearly not a part of the crystal underlying the device.

Because the reference fails to disclose every feature of the claims, the rejection is improper. Accordingly, Applicant respectfully requests the rejection be withdrawn.

Claim 25

Claim 25 recites a method of manufacturing a crystal comprising **growing a crystal wherein the growth step includes forming a first pattern in one position in the crystal** in a direction of a thickness of the crystal including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and **the crystal growth step includes forming a second pattern in another position in the crystal** in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and

each of the second elements having at least one width measured in the lateral direction, wherein the width measured in the lateral direction of at least one of the first pattern elements is different than the width measured in the lateral direction of at least one of the second pattern elements, and wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different widths.

Hayashi discloses semiconductor devices such as laser devices and light emitting diode devices formed on a nitride-based semiconductor layer (i.e., a crystal) including a substrate 21, a buffer layer 22, a GaN layer 23, two SiO₂ film layers 30, and another GaN layer 24. See Fig. 13. Hayashi does not disclose a method of manufacturing a crystal comprising growing a crystal wherein the growth step includes forming a first pattern in one position in the crystal in a direction of a thickness of the crystal including a plurality of first elements distributed in a lateral direction with respect to the crystal at a pitch, each of the first elements forming an elongate stripe extending in a longitudinal direction that is substantially orthogonal to the lateral direction and each of the first elements having at least one width measured in the lateral direction, and the crystal growth step includes forming a second pattern in another position in the crystal in the direction of the thickness of the crystal, the second pattern including a plurality of second elements distributed in the lateral direction with respect to the crystal at a pitch, each of the second elements forming an elongate stripe extending in the longitudinal direction and each of the second elements having at least one width measured in the lateral direction, wherein the width measured in the lateral direction of at least one of the first pattern elements is different than the width measured in the lateral direction of at least one of the second pattern elements, and wherein the second pattern partly overlies and partly does not overlie the first pattern in the direction of the thickness of the crystal due at least in part to the different widths.

Regarding claim 25, the Office Action maintains that the current blocking layer 31 of Hayashi is equivalent to the second nitride pattern of the present claims. However, the current blocking layer 31 is not part of the crystal, which Hayashi refers to as the nitride based semiconductor layer. See *e.g.*, column 14, lines 14-21. Various

embodiments of the crystal of Hayashi are illustrated in Figs. 9-12. Fig. 13, which the Office Action refers to, shows the crystal positioned below a semiconductor device, namely a laser device. See column 13, lines 57-59. A common purpose of the claimed crystal and the analogous nitride based semiconductor layer of Hayashi is to keep dislocations from reaching the overlying semiconductor device. See e.g., specification, page 13, lines 9-21, and Hayashi, column 12, lines 19-54, and column 14, lines 7-13. The current blocking layer 31 of Hayashi is clearly part of the laser device, which is "fabricated on the GaN layer..." (see column 13, lines 57-59), and not part of the crystal (i.e., the nitride based semiconductor layer) of Hayashi.

The present specification clearly describes the crystal. For example, the specification states that Figs. 2, 4, 5, and 7 show various embodiments of a crystal in the Brief Description of the Drawings section beginning on page 6. As another example, the specification describes that the crystal may be used in formation of a light-emitting diode or a laser device. See page 6, lines 2-6, page 11, lines 6 and 7, and page 20, lines 9-11. The description in the specification of the crystal and its position below a semiconductor device is the same as the description in Hayashi of the nitride based semiconductor layer and its position below a semiconductor device. See e.g., Hayashi, column 13, lines 57-59, and column 14, lines 14-21. Accordingly, the first and second nitride patterns in Hayashi are analogous to the recesses and projections topped by the SiO₂ film 30. See e.g., column 12, lines 21-29. However, these recesses and projections are not formed according to the claims. For example, the recesses and projections in the crystal of Hayashi are not formed so that a pitch of the recesses and a pitch of protrusions are different and so that the protrusions partly overlie and partly do not overlie the recesses in the direction of the thickness of the crystal due at least in part to the different pitches of the recesses and protrusions.

Because Hayashi fails to disclose all of the features of claim 25, the rejection is improper. Accordingly, Applicant requests that the rejection be withdrawn.

Section 103(a) - Hayashi

Applicant respectfully requests reconsideration of the rejection of claims 4 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi. The rejection is

improper because claims 4 and 5 depend from claim 1, which was improperly rejected as shown above, and the reference also fails to suggest the previously noted elements.

Section 103(a) - Hayashi in view of Fleming

Applicant respectfully requests reconsideration of the rejection of claims 17 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi in view of U.S. Patent No. 6,358,854 (Fleming). The rejection is improper because claims 17 and 19 depend from claim 1, which was improperly rejected as shown above, and the secondary reference does not provide or suggest the previously noted elements.

Section 103(a) - Hayashi in view of Major

Applicant respectfully requests reconsideration of the rejection of claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Hayashi in view of U.S. Patent No. 5,689,123 (Major). The rejection is improper because claim 20 depends from claim 1, which was improperly rejected as shown above, and the secondary reference does not provide or suggest the previously noted elements.

Conclusion

As it is believed that the application is in condition for allowance, a favorable action and a Notice of Allowance are respectfully requested.

Applicant believes there is no fee due at this time. However, the Commissioner is hereby authorized to deduct any applicable fees from Deposit Account No. 19-3140.

If the Examiner desires, Applicant welcomes a telephone interview to expedite prosecution.

Respectfully submitted,

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